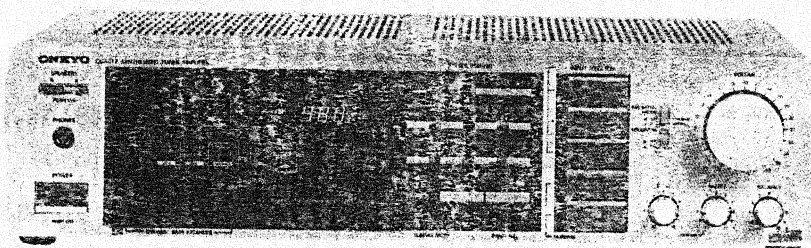


ONKYO SERVICE MANUAL

QUARTZ SYNTHESIZED TUNER AMPLIFIER MODEL TX-7230



Silver and black models

SAFETY-RELATED COMPONENT WARNING!!

COMPONENTS IDENTIFIED BY MARK \triangle ON THE SCHEMATIC DIAGRAM AND IN THE PARTS LIST ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE THESE COMPONENTS WITH ONKYO PARTS WHOSE PARTS NUMBERS APPEAR AS SHOWN IN THIS MANUAL.

MAKE LEAKAGE-CURRENT OR RESISTANCE MEASUREMENTS TO DETERMINE THAT EXPOSED PARTS ARE ACCEPTABLY INSULATED FROM THE SUPPLY CIRCUIT BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

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ONKYO
AUDIO COMPONENTS

SPECIFICATIONS

AMPLIFIER SECTION

Power Output:	40 watts per channel, min RMS, at 8 ohms, both channels driven, from 20Hz to 20kHz, with no more than 0.04% THD.
Musical Power Output:	2 × 85 watts at 4 ohms, 1kHz (DIN) 2 × 55 watts at 8 ohms, 1kHz (DIN)
Continuous Power Output:	2 × 55 watts at 4 ohms, 1kHz (DIN) 2 × 40 atwatts ato at 8 ohms, 1kHz (DIN)
Total Harmonic Distortion:	0.08% at rated power 0.08% at 1 watt output
IM Distortion:	0.08% at rated power 0.08% at 1 watt output
Damping Factor:	35 at 8 ohms
Frequency Response:	20 – 30,000 Hz ± 1 dB
RIAA Deviation:	20 – 20,000 Hz ± 0.8dB
Sensitivity and Impedance:	Phono: 2.5mV/50 kohms CD/Tape Play: 150mV/50 kohms Tape Rec: 150mV/3.5 kohms (phono) 180mV RMS at 1 kHz, 0.04% THD
Phono Overload:	180mV RMS at 1 kHz, 0.04% THD
Signal-to-Noise Ratio:	Phono: 85dB (at 10mV input, A weighted) 76dB (IHF A-202) CD/Tape: 95dB (A weighted) 80dB (IHF A-202)
Tone Controls:	Bass: ± 10dB at 100Hz Treble: ± 10dB at 10kHz
Loudness (–30dB):	+7 dB at 70 Hz, +5 dB at 10kHz
Subsonic:	–6 dB at 15 Hz

TUNER SECTION

FM:

Tuning Range:	87.5 – 108.0 MHz (50kHz steps)
Usable Sensitivity:	Mono: 12.8dBf, 1.2μV, 75 ohms 1.0μV (S/N 26dB, 40kHz Devi.) 75 ohms DIN Stereo: 18.0dBf, 2.2μV, 75 ohms 23μV (S/N 46dB, 40kHz Devi.) 75 ohms DIN
50dB Quieting Sensitivity:	Mono: 18.0dBf, 2.2μV 75 ohms Stereo: 37.2dBf, 20μV, 75 ohms
Capture Ratio:	1.5dB
Image Rejection Ratio:	85dB
IF Rejection Ratio:	90dB
Signal-to-Noise Ratio:	Mono: 71dB Stereo: 66dB
Selectivity:	50dB DIN (±300kHz, 40kHz dev.)
AM Suppression Ratio:	50dB
Harmonic Distortion:	Mono: 0.15% Stereo: 0.3%
Frequency Response:	30 – 15,000Hz ± 1.5dB
Stereo Separation:	40dB at 1kHz 30dB at 100 – 10,000Hz
Tuning Level(Hi/Lo):	–
Muting Level:	17.2dBf, 2μV
Stereo Threshold:	17.2dBf, 2μV

AM:

Tuning Range:	522 – 1611kHz (9kHz steps)
Usable Sensitivity:	30μV
Image Rejection Ratio:	40dB
IF Rejection Ratio:	40dB
Signal-to-Noise Ratio:	40dB
Harmonic Distortion:	0.8%

GENERAL

Semiconductors:	FETs: 7 TR: 37 ICs: 10 Diodes: 54 LEDs: 28
Dimensions (W×H×D):	435 × 112 × 343 mm 17-1/8" × 4-7/16" × 13-1/2"
Weight:	7.8 kg 17.2 lbs.

Specifications and features are subject to change without notice.

SERVICE PROCEDURES

1. Replacing the fuses

For continued protection against fire hazard, replace only with same type and same rating fuse.

Circuit no.	Parts no.	Description
F501, F601	252076	3.15A-SE-EAK, Primary
F902	252074	2A-SE-EAK, Primary
F903, F904	252078	5A-SE-EAK, Secondary
F905	252070	1A-SE-EAK, Secondary

2. Replacing the lamp

This unit uses the lamp listed below.

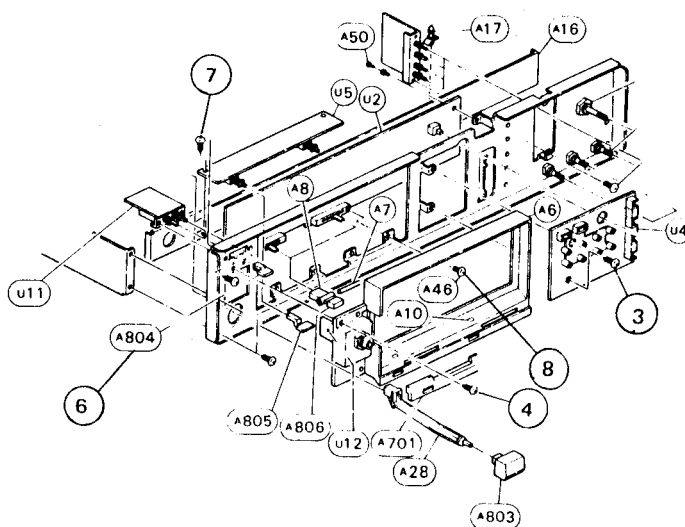
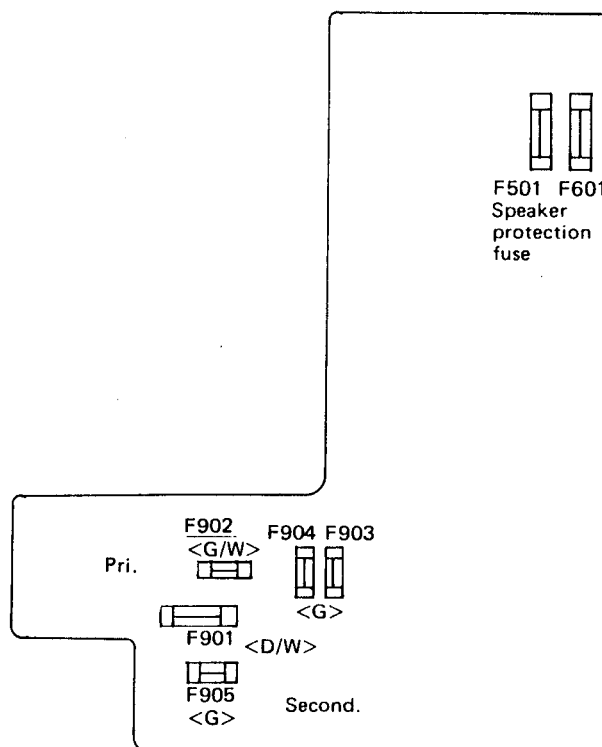
Circuit no.	Parts no.	Description
PL901	210064A	PL 6.3V, 250mA, Dial plate illumination

3. Removal of display pc board

- ①. Remove the five screws holding the top cover and chassis (side bracket: 4 back panel: 1), and remove the top cover.
- ②. Remove the five screws holding the front panel and front bracket, and remove the front panel.
- ③. Remove the two screws holding the switch pc board and front bracket, and remove the switch pc board of U4.
- ④. Remove the four screws holding the holder and front bracket.
- ⑤. Remove the display pc board ass'y from the four nails of holder, and remove the holder.
- ⑥. Remove the two knobs (A805).
- ⑦. Remove the two screws holding the NAAF-2306 pc Board ass'y and center bracket, and remove the NAAF-2306.
- ⑧. Remove the two screws holding the switch of dynamic bass expander and front bracket, and remove the display pc board.

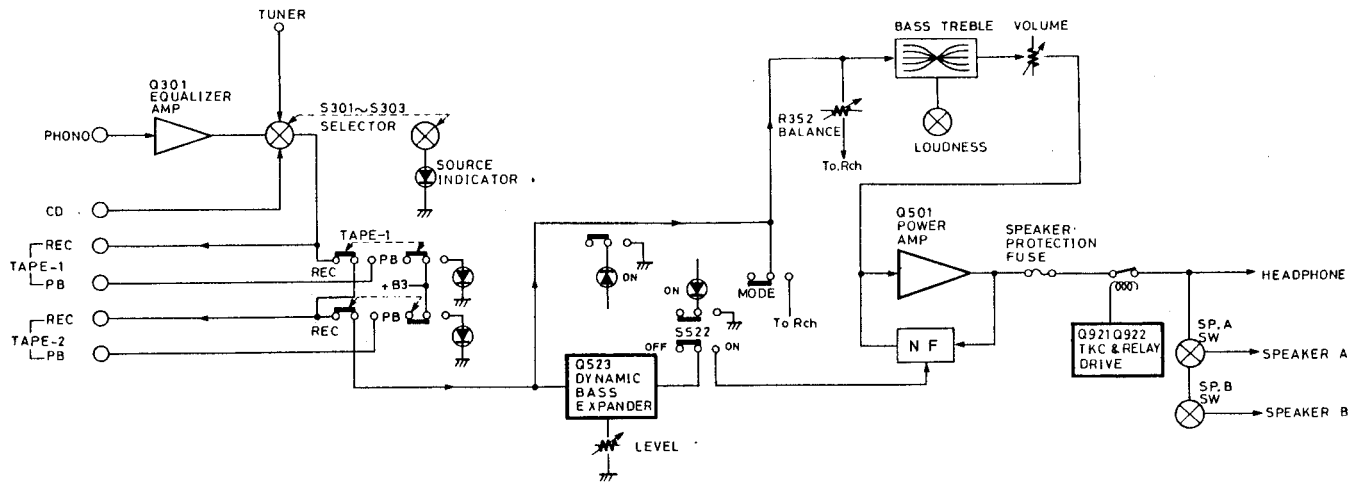
4. Memory Preservation

This unit does not require memory preservation batteries. A built-in memory power back-up system preserves contents of the memory during power failures and even when the unit is unplugged. The unit must be plugged in and the power switch turned on and off once in order to charge the back-up system. Note that since this is not a permanent memory, the power switch must be turned on and off a few times each month to keep the back-up system operable. The period of time during which memory contents are preserved after power has last been turned off varies depending on climate and the location and placement of the unit. On the average, memory contents are protected over a period of 3 to 4 weeks (a minimum of 2 weeks) after the last time power has been turned off. This period is shorter when the unit is exposed to very high humidity or used in an area with an extremely humid climate.

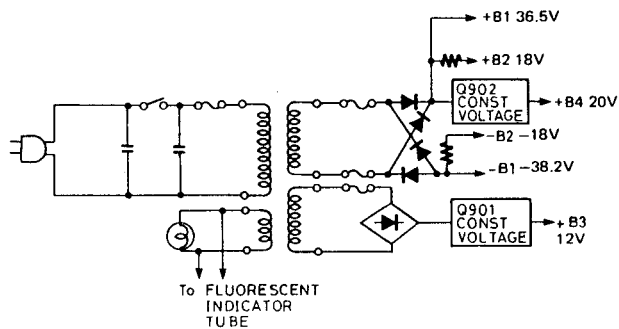


BLOCK DIAGRAM

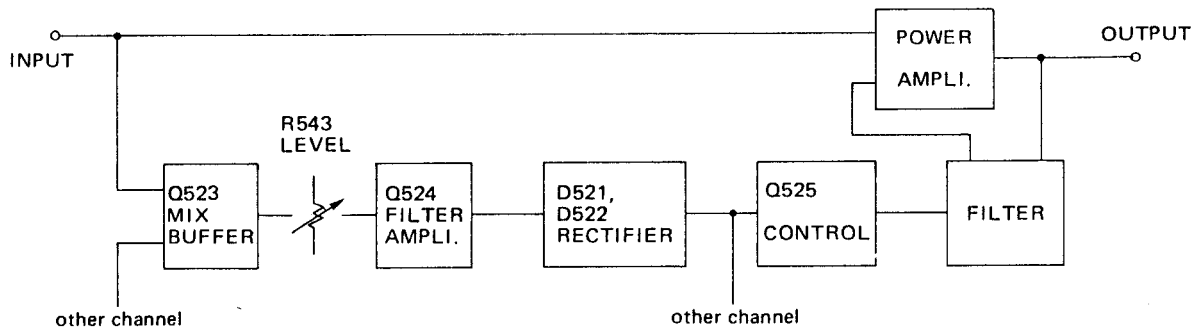
—AMPLIFIER SECTION—



—POWER SUPPLY SECTION—



—DYNAMIC BASS EXPANDER—



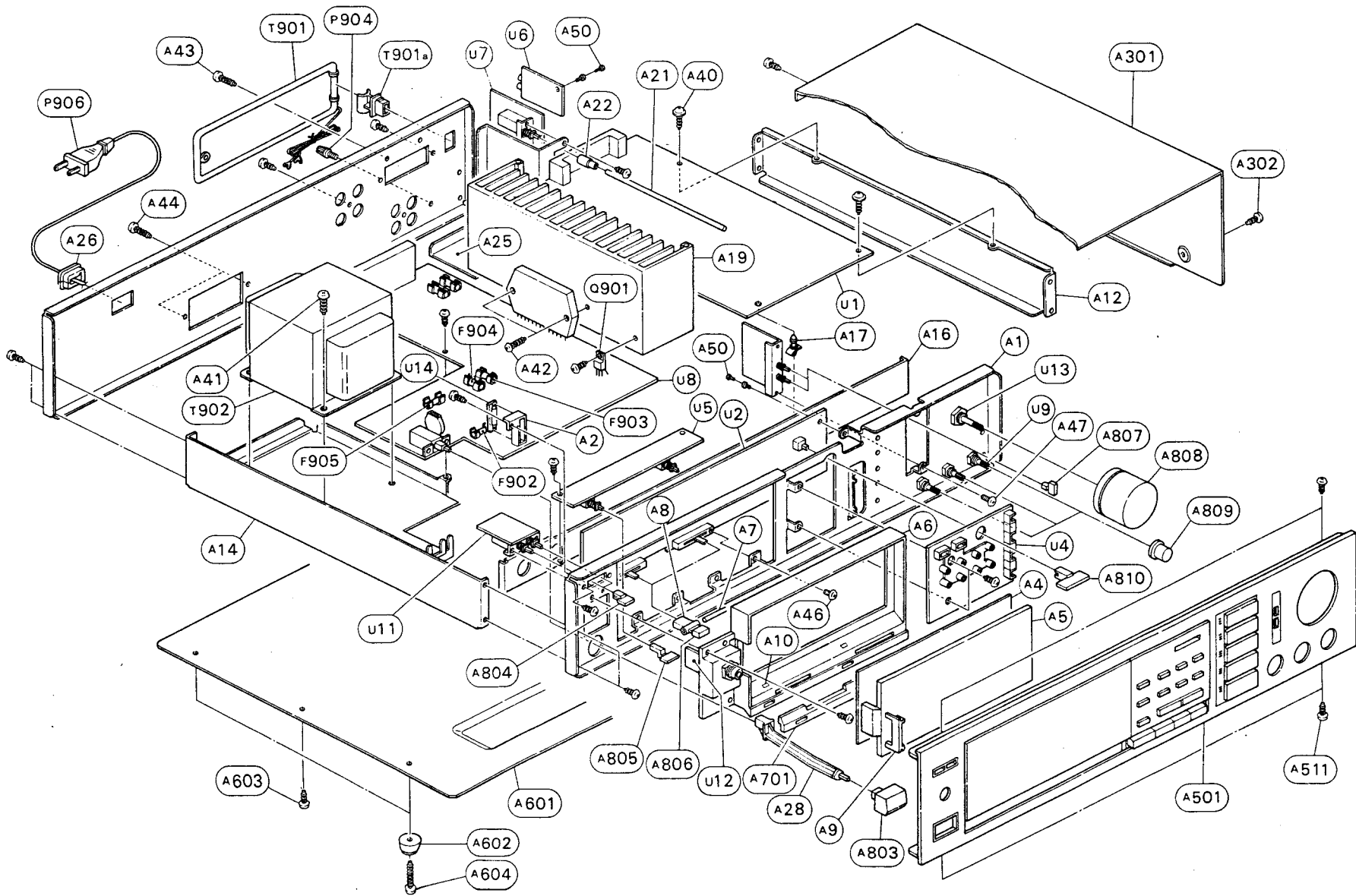
In earlier super base systems, only the frequencies about 70Hz were boosted by about 4dB to expand the playback frequency response to enable playback of the super low region. However, when there was no input signal, the above frequency response resulted in deterioration in the S/N ratio in the 70Hz region. This problem has been overcome by the dynamic bass expander where the 70Hz boosted level is varied according to the input signal level. That is, the frequency response remains flat when no input signal is applied, but is boosted at the 70Hz region to the specified level when the input signal exceeds a certain level. The left and right channel input signals from the INPUT terminals are mixed by Q523 and pass through the level volume and filter amplifier. The signal is rectified by D521 and D522, and the resultant DC component control signal is applied to the gate of Q525. When the input signal is at an adequate level, Q525 is turned on and the super base circuit of power amplifier is controlled by the input signal.

-TUNER SECTION-



EXPLODED VIEW

TX-7230



PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
A1	27110243	Front bracket
A2	27190198A	Holder, lamp
A4	28133132A	Back plate
A5	28130225B	Dial plate
A6	27190358A	Holder
A7	27260171B	Shaft
A8	27220032A	Slider
A9	27190359A	Holder, dial
A10	28198632	Facet
A12	27115180	Side bracket R
A14	27130388	Bracket, power transformer
A16	27130390	Bracket, center
A17	27190011	Holder
A19	27160174	Radiator
A21	27260172	Shaft
A22	28320135	Connector
A24	27120684	Back panel
A25	27130389B	Bracket B
A26	△ 27300750	Strainrelief
A28	27273030C	Joint L
A30	27150202	Shielded plate
A38	834430068	3TTS+6B(BC), Tapping screw
A40	831130088	3TTW+8B, Tapping screw
A41	838440089	4TTB+8C(BC), Tapping screw
A42	834430168	3TTS+16B(BC), Tapping screw
A44	834430108	3TTS+10B(BC), Tapping screw
A46	82142003	2P+3F(BC), Pan head screw
A47	82143006	3P+6FN(BC), Pan head screw
A50	880004	Rivert
A301	28184271	Top cover (S)
	28184272	Top cover (B)
A302	834430068	3TTS+6B(BC), Tapping screw
A501	18452121	Front panel ass'y (S)
A501a	27267387	Guide, speaker
A501b	27267386B	Guide, power
A501c	27267398	Guide, loudness
A501d	28191293B	Clear plate
A501e	28321992A	Selector knob ass'y
A501f	28321998A	Knob ass'y
A501	18472121	Front panel ass'y (B)
A501a	27267390	Guide, speaker
A501b	27267389B	Guide, power
A501c	27267399	Guide, loudness
A501d	28191295C	Clear plate

REF. NO.	PART NO.	DESCRIPTION
A501e	28322012A	Selector knob ass'y
A501f	28322018A	Knob ass'y
A511	838430068	3TTB+6B(BC), Tapping screw
A601	27170198A	Bottom board
A602	27175009A	Leg
A603	834430068	3TTS+6B(BC), Tapping screw
A604	834430128	3TTS+12B(BC), Tapping screw
A701	27267402A	Guide, decoration
A803	28321928	Knob, power (S)
	28321905B	Knob, power (B)
A804	28321886	Knob, speaker (S)
	28321894	Knob, speaker (B)
A805	28322005A	Knob, expander
A806	28322006	Knob, slide
A807	28322007A	Knob, loudness (S)
	28322020A	Knob, loudness (B)
A808	28321887A	Knob, volume (S)
	28321895	Knob, volume (B)
A809	28322008	Knob, balance (S)
	28322021A	Knob, balance (B)
A810	28322009A	Knob, shift (S)
	28322022A	Knob, shift (B)
F501	252076	3.15A-SE-EAK, Speaker protection fuse
F601		
F902	△ 252074	2A-SE-EAK, Primary fuse
F903	△ 252078	5A-SE-EAK, Secondary fuse
F904		
F905	△ 252070	1A-SE-EAK, Secondary fuse
P904	25060044	Terminal GND
P906	253128 AS	AS-CEE, Power supply cord
Q501	222041	STK-4843, Power amplifier IC
Q901	222780122	78M12, Constant voltage IC
T901	232085	NMA-3034, AM loop antenna
T901a	27190105	Holder, antenna
T902	△ 230870A	NPT-875G, Power transformer

NOTE:

(S): Only silver model

(B): Only black model

REF. NO.	PART NO.	DESCRIPTION
U1	18454502D	NARF-2302D, Tuner circuit pc board ass'y
U2	18454503D	NADG, 2303D, Digital circuit pc board ass'y
U4	18408505	NASW-2305, Operation switch pc board ass'y
U5	18448506A	NAAF-2306A, Dynamic bass circuit pc board ass'y
U6	18414507A	NAEQ-2307A, Equalizer amplifier pc board ass'y
U7	18414508A	NASW-2308A, Source selector switch pc board ass'y
U8	18454509D	NAAF-2309D, Power amplifier and power supply pc board ass'y
U9	18408510	NATC-2310, Tone control circuit pc board ass'y
U10	18448511A	NASW-2311A, Switch pc board ass'y
U11	18408512	NASW-2312, Speaker switch pc board ass'y
U12	18408513	NAHP-2313, Headphone terminal pc board ass'y
U13	18408514	NAVR-2314, Volume control pc board ass'y
U14	18414516	NAPL-2316, Edge light pc board ass'y

NOTE: THE COMPONENTS IDENTIFIED BY MARK △ ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE ONLY WITH PARTS NUMBER SPECIFIED.

CIRCUIT DESCRIPTIONS

1. Synthesizer and controller operation

Pin No.	Symbol	Terminal	Description
1	GND	Ground	
2	XT	X'tal	Connected to the 7.2MHz crystal oscillator for the reference frequency.
3	XT		
4	FM	FM band specification input	Mutual reset type, performs switching of each band, FM/MW/LW.
5	MW	MW band specification input	
6	LW	LW band specification input	
7	MANUAL	Manual tuning mode specification input	Mutual reset type, performs auto search and manual operation mode switching during UP/DOWN tuning.
8	AUTO	Auto search tuning mode specification input	
9	UP	UP tuning key input	Connect the push key and perform UP/DOWN tuning.
10	DOWN	DOWN tuning key input	
11	STO	Memory store command input	The preset memory is set to the write mode when the key is pressed.
12-19	M1-M8	Preset memory channel specification input	Controls the write and read out of the internal 16-station preset memory along with the MC1 and MC2 input.
20	MC-1	Memory control input	Set the 16-station preset memory to the 8 FM/8 AM station mode or the FM/MW/LW 3-band 16-station random mode. The 8 FM/8 AM mode is used in this unit.
21	MC-2		
22	OSC2	AM oscillator terminal	CR connection terminal for the oscillator that determines the scan speed during the AM search mode.
23	OSC1	FM oscillator terminal	CR connection terminal for the oscillator that determines the scan speed during the FM search mode.
24	O/5	FM 50 kHz output	Output that represents the 50kHz FM band tuning step for European models. Goes to the high level for the 50 kHz setting.
25	CK2	Tuned frequency data output	Outputs the serial data and timing clock to the tuned frequency display driver.
26	CK1		
27	DATA		
28	MUTE	Muting signal output	Goes to the high level during muting output.
29	E2	Regin specification input	See table 1.
30	E1		
31	STOP 3	AM IF signal input	During AM reception, this counts the IF signal and stops auto search.
32	STOP 2	Auto search stop signal input	When the stop 1 input (pin 33) is at the high level and this terminal goes to the high level, auto search is stopped.
33	STOP 1	Scan speed slow input	When the high level is input at this terminal, the auto search speed is cut in half.

Pin No.	Symbol	Terminal	Description
34	DO1	Error output	Charge pump output of the phase detector which constitutes the PLL. High level is output when the divided oscillation frequency is high than the reference frequency. In the opposite case, low level is output. Floating occurs when the frequencies match. The output is applied to the variable capacitor diode in the front end through low pass filter Q704 and Q705. The output from both terminals is the same, but only DO1 is used.
35	DO2		
36	TEST	Test terminal	Test mode at the high level.
37	FM IN	FM programmable counter input	Connect to the prescaler output (Pin3 of Q701)
38	PSC	Pulse swallow control output	Output to the control the division ratio of the prescaler.
39	AM IN	AM local oscillator signal input	Terminal for input of AM broadcast signal.
40	$\overline{\text{INH}}$	Inhibit input	Operates normally at the high level. Inhibit status at the low level.
41	$\overline{\text{INT}}$	Initialize input	Operates normally at the high level. At the low level, the internal status is initialized.
42	VDD	Power supply	Device power terminal; supplies 5V during the normal operation and 2.5V from the super capacitor (C712) for memory preservation.

table 1.

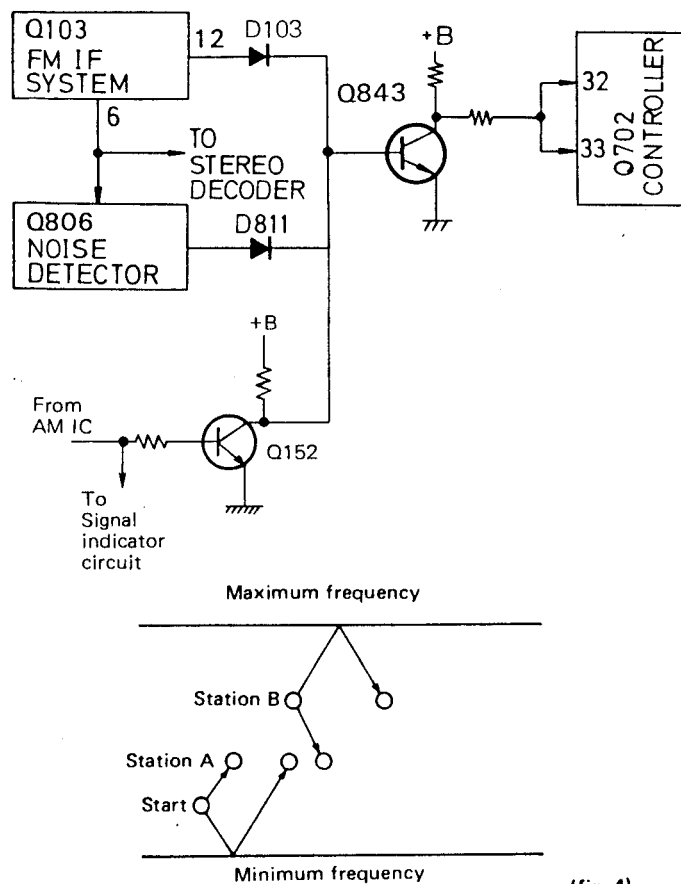
E1 (Pin 30)	E2 (Pin 29)	Region	Band	Frequency range	Intermediate frequency	Scan step	Reference frequency
0	1	U.S.A	FM	87.5 ~ 108.0 MHz	+10.7 MHz	100 kHz	25 kHz
			AM1	520 ~ 1 710 kHz	+450 kHz	10kHz	10 kHz
1	1		AM2	522 ~ 1 710 kHz	+450 kHz	9kHz	9kHz
1	0	Europe	FM	87.50 ~ 108.00 MHz	+10.7 MHz	50 kHz	25 kHz
			MW	522 ~ 1611 kHz	+450 kHz	9 kHz	9 kHz
			LM	153 ~ 360 kHz	+450 kHz	1 kHz	1 kHz
0	0	Japan	FM	76.0 ~ 90.0 MHz	-10.7 MHz	100 kHz	25 kHz
			AM	522 ~ 1611 kHz	+450 kHz	9 kHz	9 kHz

2. Auto Hi-blend switch circuit

The Q103 FM IF system incorporates IC's with a built-in IF level detector with a 13 pin output.

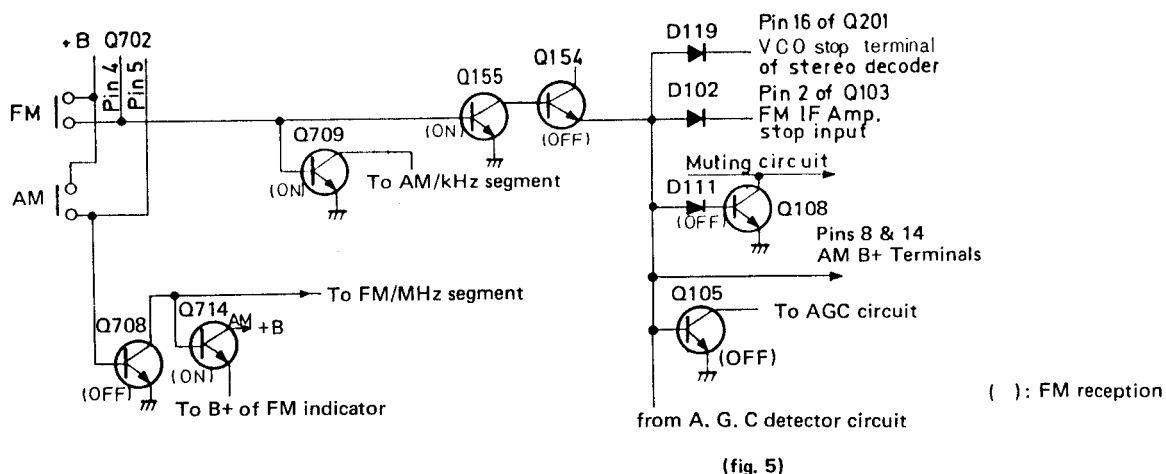
If an input above 38dB enters the antenna, Q205 is turned on, and Q721 is turned on, the Q722 and Q202 are turned off and the high blend function is turned off.

3. Auto search tuning circuit



(fig. 4)

4. FM/AM switch circuit



(fig. 5)

The FM/AM selector circuit is shown in the diagram, fig. 5. Pins 4 and 5 of Q702 are of the mutual reset type. For FM, pin 4 is high and pin 5 is low; for AM, pin 4 is low and pin 5 is high. Because pin 5 is high and pin 4 is low during AM reception, Q709 is off, the AM, kHz segments of the fluorescent display are turned on. Also, since Q708 goes to on and Q714 is turned off, and the FM indicators are turned off. At the same time, Q155 is turned off and Q154 turned on, so +B is supplied to the power source terminal of the radio

During FM reception, this is operated by the IF level detection and zero point detection circuits included in the FM IF system IC of Q103 and by the noise component detection circuit of Q806. When a station is tuned, the output of all outputs go to the low level so Q843 goes from on to off, causing pins 32 and 33 of the controller IC to go to the high level to complete auto search tuning.

During AM reception, this is operated by the IF level detection included in the AM radio system IC of Q151. When a station is turned, Q152 goes from off to on and Q706 goes to off, causing pins 32 and 33 of the controller IC to go to the high level to complete auto search tuning.

• Manual Tuning

When the UP or DOWN key is pressed, the frequency goes up or down by one step. When either key is held down, the frequency rapidly increases or decreases (scans) and stops when the key is released. When either end of the turning range is reached, key input will no longer be received and the frequency will stop at the highest or lowest frequency.

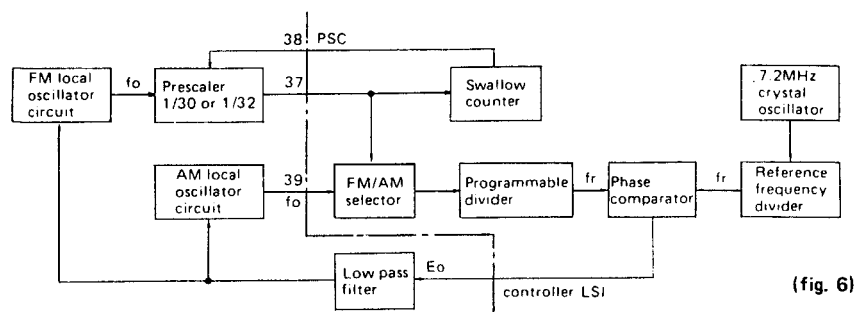
• Auto Tuning

When the UP or DOWN key is pressed, scanning begins in the up or down direction, stopping where there is a radio station. Since auto scan is operated by a triangular wave, scanning is begun in the opposite direction the instant either end of the tuning range is reached. Also, if the UP or DOWN key is pressed when the tuned frequency is not at either end of the range, up or down scanning will begin.

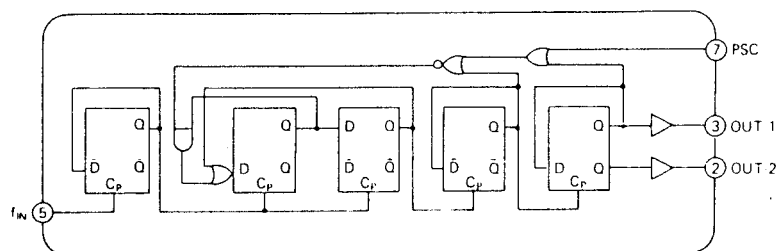
system pins 8 & 14 of Q151.

Pin 16 of Q201 goes to the high level, the VCO oscillator stops, and pin 2 of Q103 goes to the high level so the FM IF amp is also switched off. Also, during AM reception, Q108 is turned on so the muting circuit is off. During FM reception, all of the switching transistors mentioned above perform the opposite operations to switch to the FM mode. Figures in parentheses indicate transistor operation during FM reception.

5. PLL tuned circuit



(fig. 6)



(fig 7) TD6104P (Prescaler)

A block diagram of the tuned circuit of the PLL is shown in figer 6.

Operation during AM reception

The reception frequency is applied to the programmable divider where it is divided to $1/N$ and output as f_v . This is applied to the phase comparator where it is compared with frequency reference f_r (9kHz for G/W model and 10kHz for D model). If f_r and f_v differ, E_o equal to the difference in frequency is output. Since error output E_o is a pulse waveform, it is passed through the low pass filter to change it into DC voltage V_o , which is applied to the variable capacitor diode in the front end to change the reception frequency. This continues until f_v and f_r are the same and $E_o = 0$.

Operation during FM reception

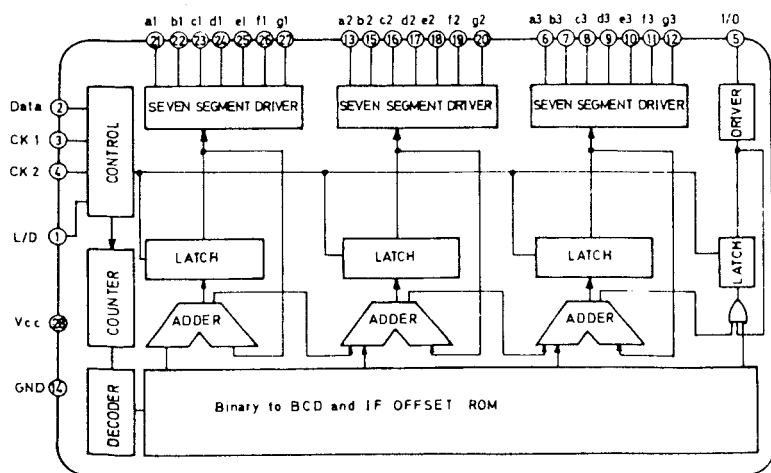
The pulse swallow method is used in the prescaler of this unit. In this type of prescaler, a supplementary number

(changed according to the program code input) and the divided reception frequency from the prescaler are combined in the control counter and the prescaler's division factor is switched 1/30 or 1/32 according to external control (1/32 when the PSC terminal is "H" and 1/30 when it is "L").

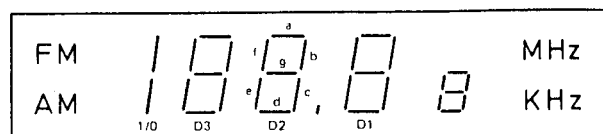
The station oscillator frequency is applied to the programmable divider, but the programmable divider has an upper frequency limit of only 30 MHz, so the pulse swallow-type prescaler, which can be used up to 150 MHz, is inserted for division to $1/Np$:

The signal is applied to the programmable divider and divided to $1/N$. The result is compared with a 25kHz frequency reference in the phase detector and the error is output as E_o until a match is obtained as in AM operation.

6. Frequency indicator circuit

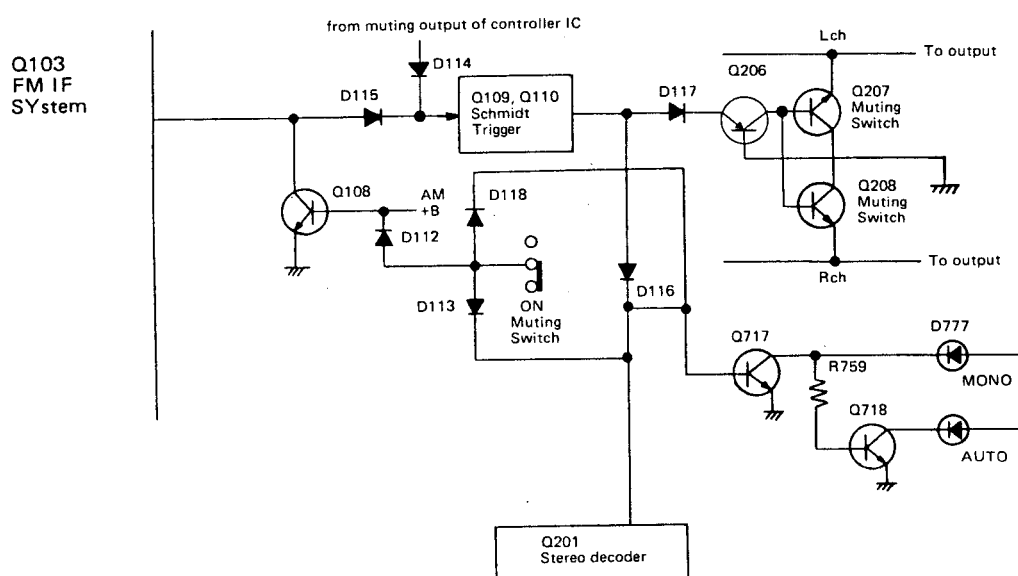


(fig. 8) TD6301AP block diagram



Pin No.	Terminal	Description
1	L/D	Output indication switching input terminal: Fluorescent display at the low level, and LED display at the high level.
2	Data	Tuned frequency data input terminal: Input from the system controller LSI to the serial.
3,4	CK1, CK2	Tuned frequency data input control timing input terminal: Transferred simultaneously with data from the system controller LSI.
5	I/O	Segment drive output terminal: Sets the number of display digit for FM (100MHz) and AM (1,000kHz) reception.
6-12	a3-g3	Seven segment drive output terminals: Sets the number of display digit for FM(10MHz) and AM (100kHz) reception.
13, 15-20	a2-g2	Seven segment drive output terminals: Sets the number of display digit for FM (1MHz) and AM (10kHz) reception
21-27	a1-g1	Seven segment drive output terminals; set the number of display digit for FM (100kHz) and AM (1kHz) reception
14	Vcc	Power source terminal
28	Gnd	Ground

7. Muting circuit



The muting circuit operates in the following cases.

1. While pin 28 of the controller IC outputs the high level, Q207 and Q208 are turned on and muting is closed in the following cases: (1) While the manual UP/DOWN switch is being held down, (2) When a station in the memory is recalled, and (3) While a radio station is being received using auto search tuning.
2. When an FM station is not being received (and the muting switch is on).

The IF level in the FM IF system (set at R120 so muting is opened at 17 dBf (low position)) and zero point detection circuit (tuning point 55kHz (100kHz step): 30kHz

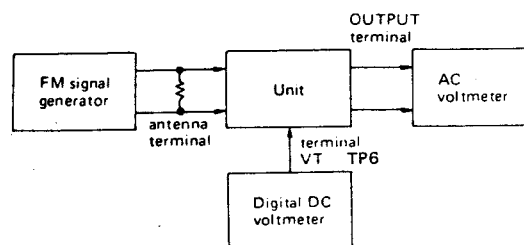
(50kHz step)— are output at pin 12 through the AND circuit. When a station is tuned, the output goes to the low level.

When output goes to the low level, Q109 is turned off, Q110 is turned on and Q207 and Q208 are turned off, so muting is opened. At the same, pin 16 of stereo decoder Q201 goes to the low level, so the VCO oscillator starts.

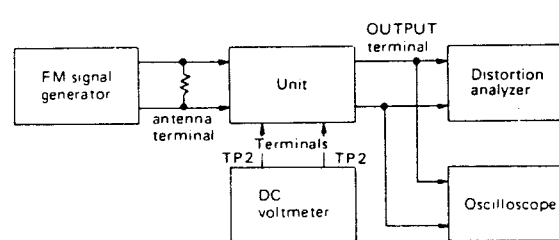
ADJUSTMENT PROCEDURES

FM section

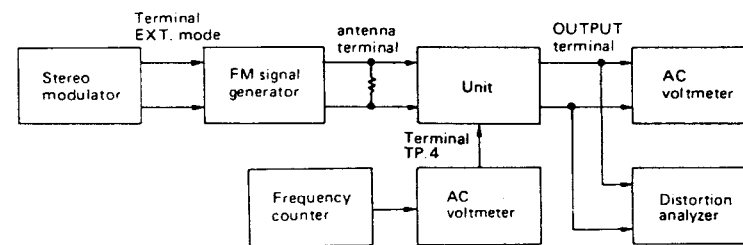
Item	Step	Connection of instrument	FM SG output	Stereo modulator output	Turning dial setting	Output indicator	Adjustment	Adjust for	Remarks
FM RF	1	Fig. 1	—	—	88.0 MHz	Digital DC voltmeter	OSC	1.4V	Usually not necessary to adjust.
	2	Fig. 1	107.9 MHz 1 kHz, 75 kHz devi.	—	107.9 MHz	AC voltmeter	RF	Maximum output	
FM IF	1	Fig. 2	99.0 MHz 1 kHz, 75 kHz devi. 65 dBf (60 dB)	—	99.0 MHz	DC voltmeter	L102 Primary coil	0V	Muting switch : off Repeat the steps 1 and 2 until no further adjustment is necessary
	2	Fig. 2		—	99.0 MHz	Distortion analyzer	L102 Secondary coil	Minimum	
VCO		Fig. 3	99.0 MHz 1 kHz, 75 kHz devi. 65 dBf (60 dB)	—	99.0 MHz	Frequency counter	R215	19 kHz \pm 10 Hz	Muting switch: no
Distortion		Fig. 3	99.0 MHz 65 dBf (60 dB) Ext. modulation	L+R 1 kHz	99.0 MHz	Distortion analyzer	IF	Minimum	
Separation	1	Fig. 3	99.0 MHz 65 dBf (60 dB) Ext. modulation	L ch. 1 kHz	99.0 MHz	R ch. AC voltmeter	R203	Minimum	Maximum and same separation
	2			R ch. 1 kHz		L ch. AC voltmeter		Minimum	
Muting level	1	Fig. 2	99.0 MHz 17.2 dBf (12 dB) 1 kHz, 75 kHz devi.	—	99.0 MHz	Oscilloscope	R120	Signal output	Muting switch: on
	2		99.0 MHz 16.2 dBf (11 dB) 1 kHz, 75 kHz devi.					No output	



(fig. 1)



(fig. 2)



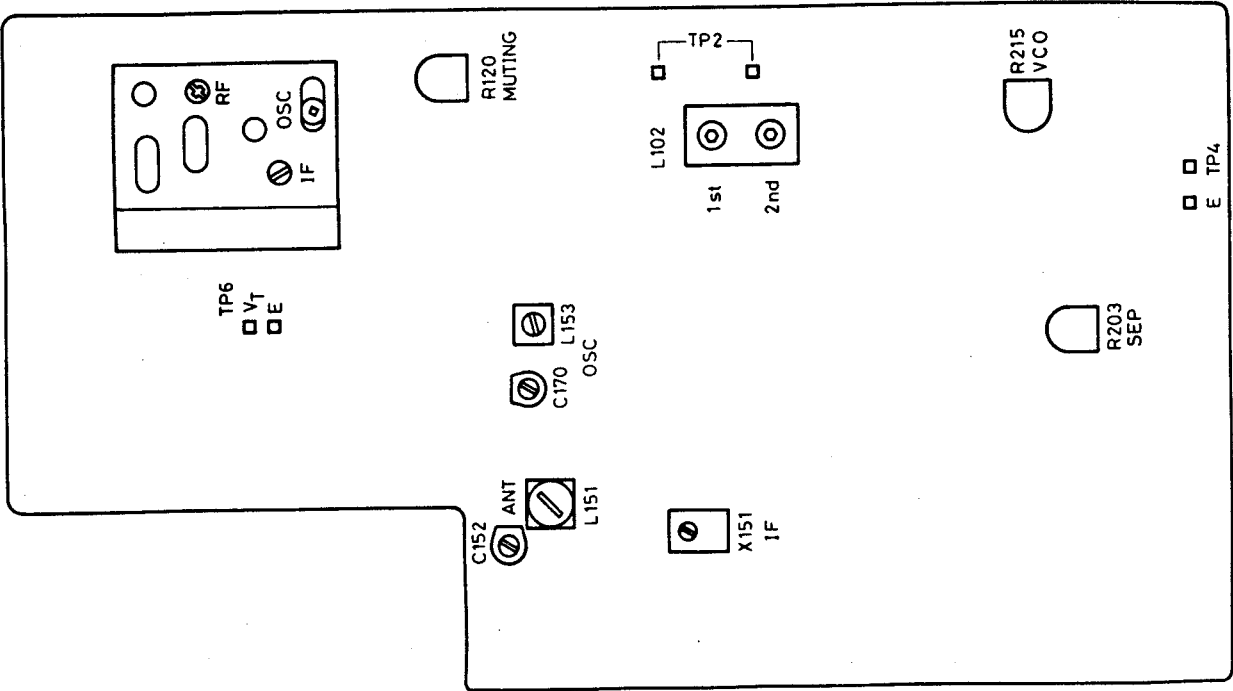
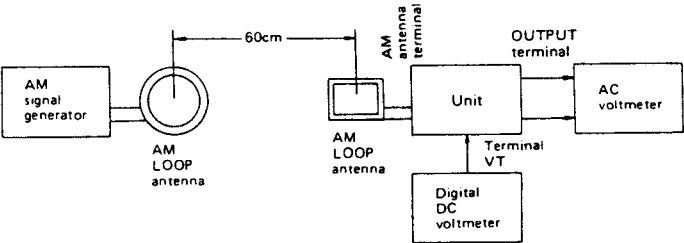
(fig. 3)

AM section

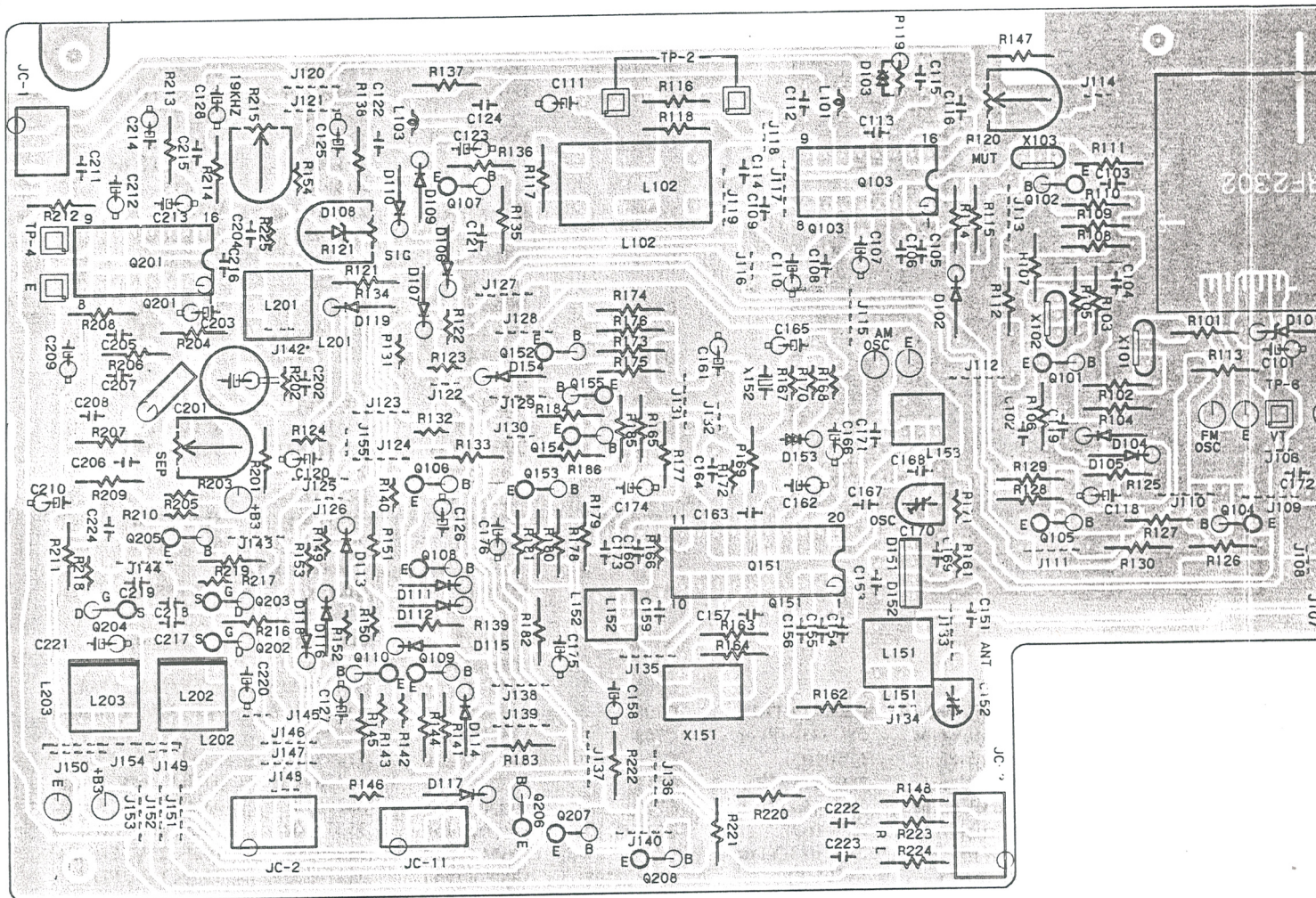
Step	AM SG	Tuned	Output	Adjustment	Adjust for	Remarks
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AM section

Step	AM SG output	Tuned frequency	Output indicator	Adjustment point	Adjust for	Remarks
1		522kHz	Digital DC voltmeter	L153	1.2V	Repeat the steps 1 and 2 until no further adjustment is necessary.
2		1611kHz	Digital DC voltmeter	C170	9.0V	
3	603kHz (600kHz) 400Hz 30% mod.	603kHz	AC voltmeter	L151	Maximum	Repeat the steps 3 and 4 until no further adjustment is necessary.
4	1404kHz (1400kHz) 400Hz 30% mod.	1404kHz	AC voltmeter	C152	Maximum	
5	999kHz (1000kHz) 400Hz 30% mod.	999kHz	AC voltmeter	X151	Maximum	

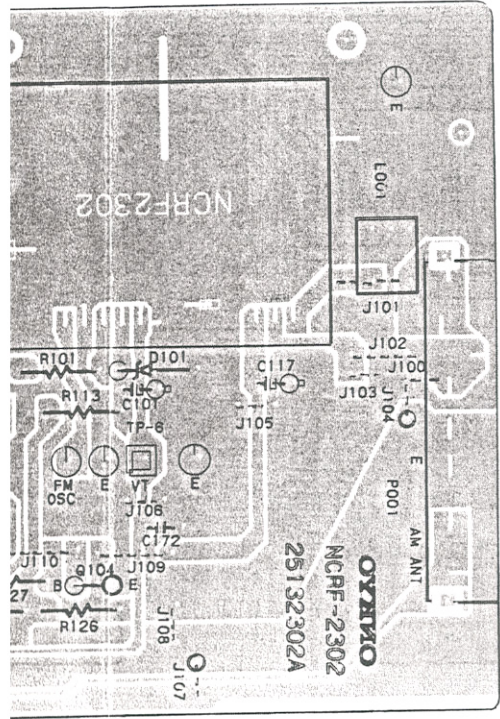


TUNER CIRCUIT PC BOARD



TUNER CIRCUIT PC BOARD(NARF-2302D)

TUNER CIRCUIT PC BOARD(NARF-2302D)			CIRCUIT NO.	PART NO.	DESCRIPTION	CIRCUIT NO.
CIRCUIT NO.	PART NO.	DESCRIPTION		Transistors		
	Front end		Q206	2211454 or	2SA1015(Y) or	L153
TU001	240059	FE416U33		2212494	JA101(P)	L201
	ICs		Q207,Q208	2211705 or	2SD655(E) or	L202,L203
Q103	222540	HA-11225		2211706	2SD655(F)	
Q151	222701	LA-1245		Diodes		L102
Q201	222678	μPC-1161C3	D101	2243192 or	MTZ8, 2B or	
	Transistors			2239552	RD8, 2EB2	X101-X103
Q101	2211723 or	2SC1923(O) or	D102,D106	223150,	US1040,	X151
	2211722	2SC1923(R)	D109-D119	223145 or	1S2076TD or	X152
Q102	2211723 or	2SC1923(O) or		223124	1S2473	
	2211722	2SC1923(R)	D108	2243132 or	MTZ4.7B or	C101
Q104,Q105	2211255,	2SC1815(GR),	D104,D105	2239432	RD4.7EB2	C107,C110
Q107-Q110	2210746 or	2SC945A(P) or	D151,D152	223132	1K60	C111
Q152	2212485	JC501(Q)		223140	KV1236	C117
Q154,Q155	2211255,	2SC1815(GR),	L001	Coils		C118
	2210746 or	2SC945A(P) or	L101	233312	NFA-3051	C120
	2212485	JC501(Q)		233105 or	NCCH-1005 or	C123
Q153,Q106	2211256	2SC1815(BL)	L103	233024	NCCH-1501	C125
Q205			L151	233031	NMC-9-1	C126
Q202	2211945 or	2SK246(GR) or		232113	NMA-3049	C128
	2212304	2SK381(D)				

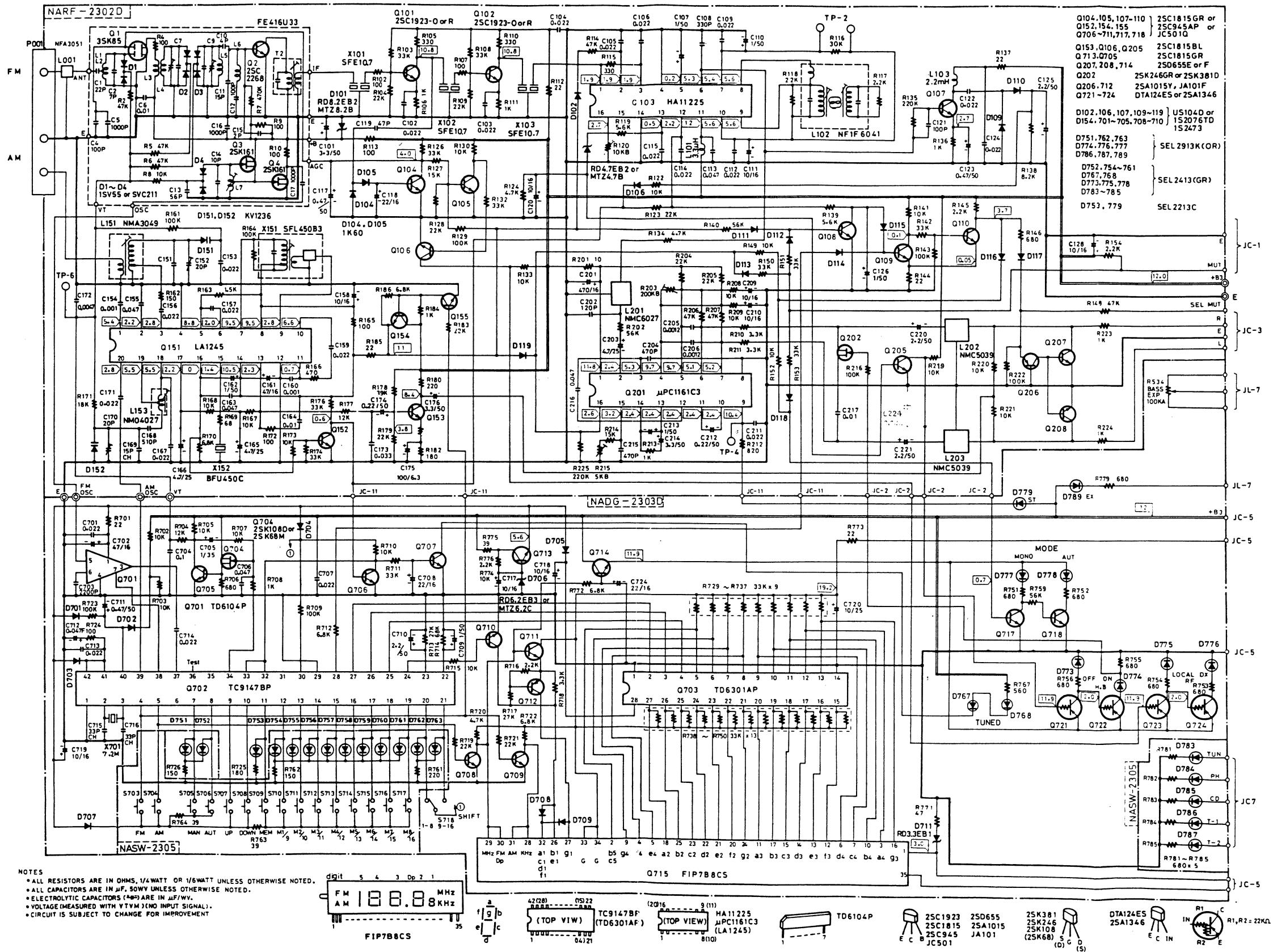


CIRCUIT NO.	PART NO. Capacitors	DESCRIPTION
C152	3060010	NTC-20P09, Trimmer
C158	352741009	10 μ F, 16V, Elect.
C161	352744709	47 μ F, 16V, Elect.
C162	352780109	1 μ F, 50V, Elect.
C165,C166	352750479	4.7 μ F, 25V, Elect.
C168	370135114	510pF \pm 5%, 100V, APS
C170	3060010	NTC-20P09, Trimmer
C174	352782299	0.22 μ F, 50V, Elect.
C175	352721019	100 μ F, 6.3V, Elect.
C176	352780339	3.3 μ F, 50V, Elect.
C201	352744719	470 μ F, 16V, Elect.
C203	352750479	4.7 μ F, 25V, Elect.
C209,C210	352741009	10 μ F, 16V, Elect.
C212	352782299	0.22 μ F, 50V, Elect.
C213	352780109	1 μ F, 50V, Elect.
C214	352780339	3.3 μ F, 50V, Elect.
C215	370134714	470pF \pm 5%, 100V, APS
C220,C221	352780229	2.2 μ F, 50V, Elect.
	Resistors	
R120	5215045	N08HR10KBC, Semi-fixed
R203	5215048	N08HR200KBC, Semi-fixed
R215	5215044	N08HR5KBC, Semi-fixed
	Terminal	
P001	25060087	NTM-2PDMN31, Antenna
	Sockets	
	25050141	NJPS-4P-S
	25050140	NJPS-3P-S

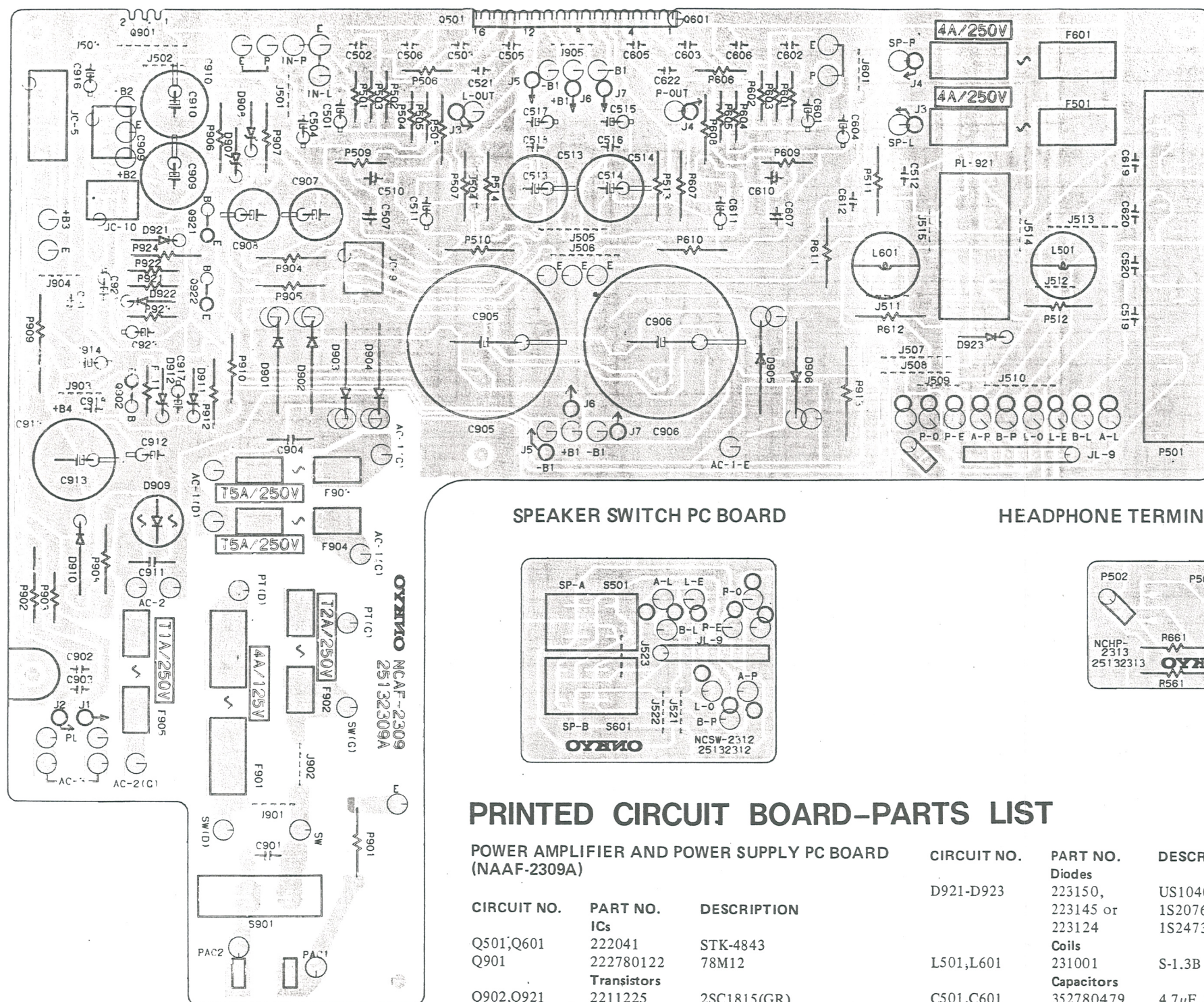
CIRCUIT NO.	PART NO.	DESCRIPTION
	Coils	
L153	232110	NMO-4027
L201	233236	NMC-6027
L202,L203	233291	NMC-5039
	Transformer	
L102	233274	NFIF-6041
	Ceramic filters	
X101-X103	3010043	SFE10.7MM
X151	3010075	SFL450B3
X152	3010076	BFU450C
	Capacitors	
C101	352780339	3.3μF, 50V, Elect.
C107,C110	352780109	1μF, 50V, Elect.
C111	352741009	10μF, 16V, Elect.
C117	352784799	0.47μF, 50V, Elect.
C118	352742209	22μF, 16V, Elect.
C120	352741009	10μF, 16V, Elect.
C123	352784799	0.47μF, 50V, Elect.
C125	352780229	2.2μF, 50V, Elect.
C126	352780109	1μF, 50V, Elect.
C128	352741009	10μF, 16V, Elect.

SCHEMATIC DIAGRAM

-TUNER SECTION-



POWER AMPLIFIER AND POWER SUPPLY CIRCUIT PC BOARD

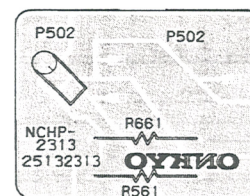


POWER AMPLIFIER AND POWER SUPPLY PC BOARD (NAAF-2309A)

CIRCUIT NO.	PART NO. ICs	DESCRIPTION
Q501,Q601	222041	STK-4843
Q901	222780122	78M12
	Transistors	
Q902,Q921	2211225	2SC1815(GR)
Q922	2211254	2SC1815(Y)
	Diodes	
D901-D906	223845	GP-20D
D907,D908	2243273,	MTZ18C,
	2241191,	GZA18X,
	2241192 or	GZA18Y or
	2239713	RD18EB3
D909	223862	WL01
D910	223880	GP101N4003
D911	2241291	RD3.3EB1
D912	2239733 or	RD20EB3 or
	2243283	MTZ20C

CIRCUIT NO.	PART NO.	DESCRIPTION
	Diodes	
D921-D923	223150,	US1040,
	223145 or	1S2076TD or
	223124	1S2473
	Coils	
L501,L601	231001	S-1.3B
	Capacitors	
C501,C601	352780479	4.7μF, 50V, E
C504,C604	352731019	100μF, 10V, E
C507,C607	352984799	0.47μF, 50V, N
C510,C610	352984799	0.47μF, 50V, N
C511,C611	352784709	47μF, 50V, Ele
C513,C514	352781019	100μF, 50V, E
C515,C517	352781009	10μF, 50V, Ele
C901	Δ3500065A	0.01μF, AC400
C905,C906	3504177	6,800μF, 42V, E
C907,C908	352761019	100μF, 35V, E
C909,C910	352752219	220μF, 25V, E

HEADPHONE TERMINAL PC BOARD



CIRCUIT NO.	PART NO.	DESCRIPTION
	Capacitor	
C912	352761019	100 μ F, 35V, Elect.
C913	352752229	2,200 μ F, 25V, Elect.
C914	352751019	100 μ F, 25V, Elect.
C916	352741009	10 μ F, 16V, Elect.
C917	352780109	1 μ F, 50V, Elect.
C921	352753309	33 μ F, 25V, Elect.
C923	352780339	3.3 μ F, 50V, Elect.
	Resistors	
R507,R607	441521024	1k Ω , 1/2W, Metal oxide film
R508,R608	441523324	3.3k Ω , 1/2W, Metal oxide film
R510,R610	441522424	2.4k Ω , 1/2W, Metal oxide film
R511,R611	441520474	4.7 Ω , 1/2W, Metal oxide film
R512,R612	441520474	4.7 Ω , 1/2W, Metal oxide film
R513	441525614	560 Ω , Metal oxide film
R514	441521014	100 Ω , 1/2W, Metal oxide film
R902	441523904	39 Ω , 1/2W, Metal oxide film
R904-R907	441524314	430 Ω , 1/2W, Metal oxide film
R908	441621024	1k Ω , 1W, Metal oxide film
R909	441720624	6.2 Ω , 2W, Metal oxide film
R910	441624714	470 Ω , 1/2W, Metal oxide film
R924	441522704	27 Ω , 1/2W, Metal oxide film
	Terminal	
P501	25060058	NTM-8PDML25, Speaker
	25060092	NTM-1S33
	Switch	
S901	△ 25035398	NPS-111-L362P, Power
	Relay	
RL921	25065134	NRL-2P5A-DC24V-07
	Fuses	
F501,F601	△ 252076	3.15A-SE-EAK, Speaker protection
F902	△ 252074	2A-SE-EAK, Primary
F903,F904	△ 252078	5A-SE-EAK, Secondary
F905	△ 252070	1A-SE-EAK, Secondary
	Fuseholders	
	△ 25050065	YSH403T
	Cover	
C901a	△ 27300601	SB-1925, Capacitor for C901
	Sockets	
	25050140	NJPS-3P-S
	25050143	NJPS-6P-S
	Label	
	29360472	T3.15A/250V, Fuse, rating

SPEAKER SWITCH PC BOARD (NASW-2312)

CIRCUIT NO.	PART NO.	DESCRIPTION
S501,S601	25035467	NPS-212-L429, Speaker switch

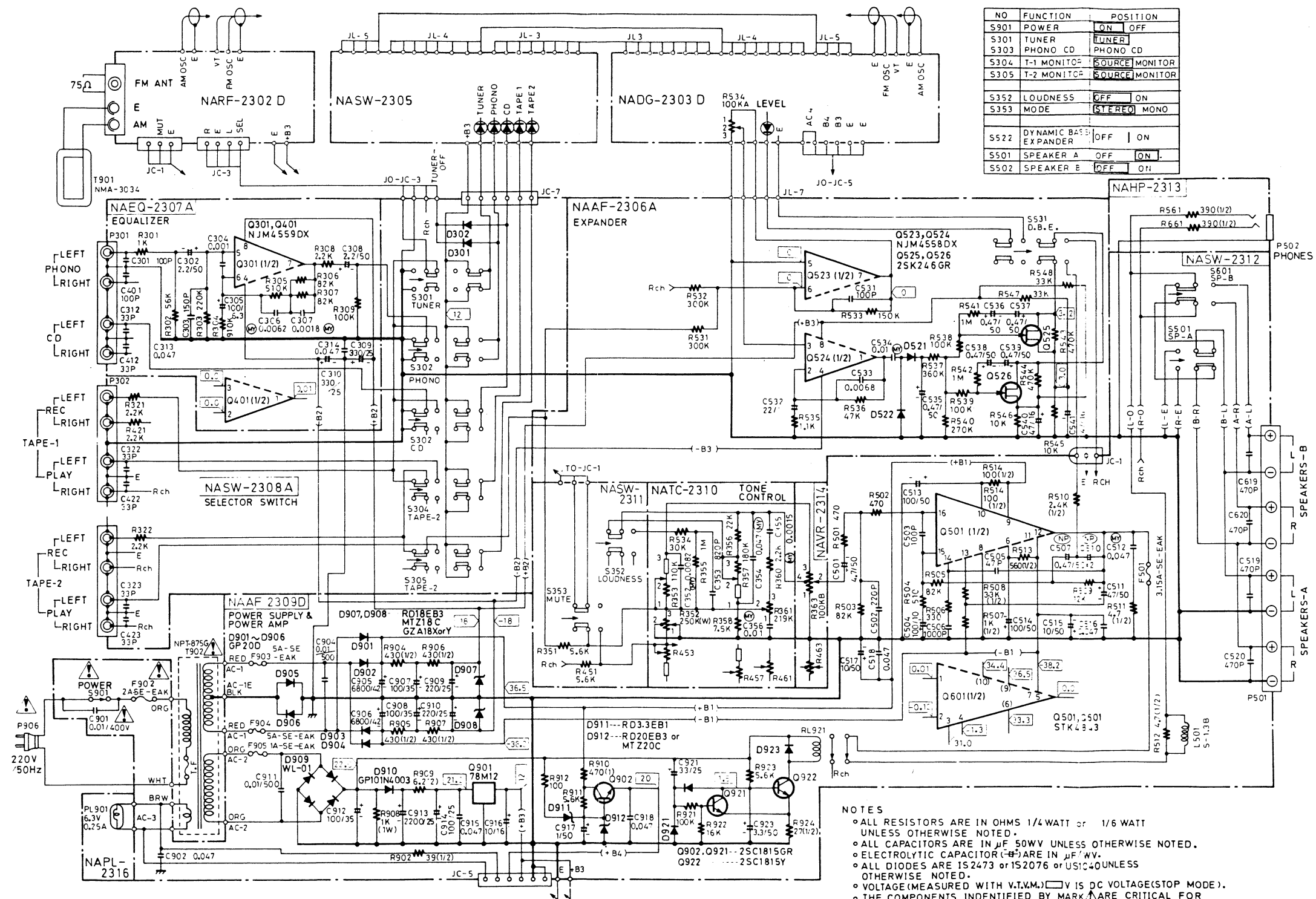
HEADPHONE TERMINAL PC BOARD(NAHP-2313)

CIRCUIT NO.	PART NO.	DESCRIPTION
P502	25045138	HLJ0520-01-010, Headphone terminal
R561,R661	441523914	390Ω, 1/2W, Metal oxide film resistor

NOTE: THE COMPONENTS IDENTIFIED BY MARK
 ▲ ARE CRITICAL FOR RISK OF FIRE AND
 ELECTRIC SHOCK. REPLACE ONLY WITH
 PARTS NUMBER SPECIFIED.

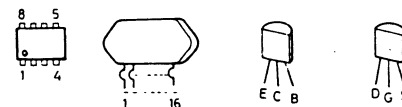
SCHEMATIC DIAGRAM

-AMPLIFIER SECTION-

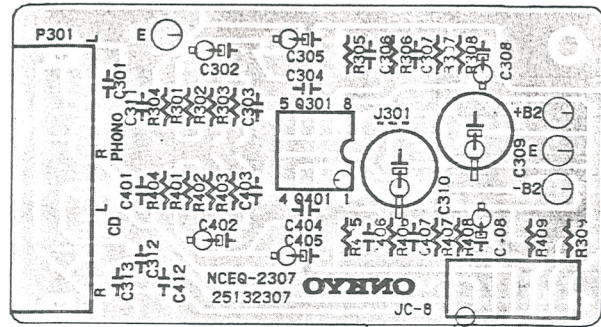


Q301, Q302, Q501, Q601
Q523, Q524

Q902, Q921, Q525, Q526,
Q922



EQUALIZER AMPLIFIER PC BOARD



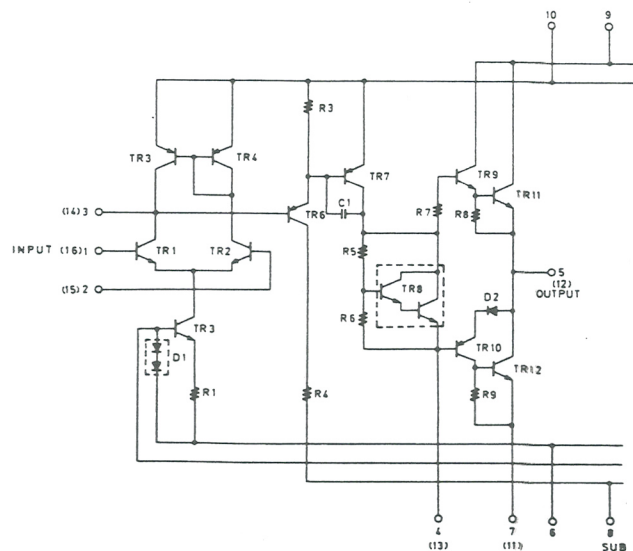
EQUALIZER AMPLIFIER PC BOARD(NAEQ-2307A)

CIRCUIT NO.	PART NO. IC	DESCRIPTION
Q301,Q302	222534	NJM-4559DX
	Capacitors	
C302,C402	352780229	2.2 μ F, 50V, Elect.
C305,C405	352721019	100 μ F, 6.3V, Elect.
C308,C408	352780229	2.2 μ F, 50V, Elect.
C309,C310	352753319	330 μ F, 25V, Elect.
	Terminal	
P301	25045142	NPJ-4PDBL55

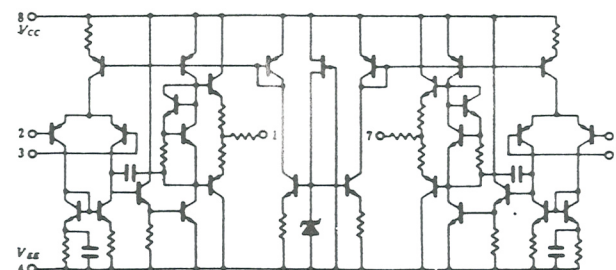
DYNAMIC BASS CIRCUIT PC BOARD(NAAF-2306A)

CIRCUIT NO.	PART NO. ICs	DESCRIPTION
Q523,Q524	222502	NJM4558DX
	Transistors	
Q525,Q526	2211945	2SK246(GR)
	Diodes	
D521,D522	223124, 223145 or 223150	1S2473, 1S2076TD or US1040
	Capacitors	
C532	352732209	22 μ F, 10V, Elect.
C535-C539	352784799	0.47 μ F, 50V, Elect.
C540,C541	352744709	47 μ F, 16V, Elect.
	Switch	
S531	25035480	NPS-142-L442, Push

STK-4843(Power amplifier)



NJM4558/4559(Operation amplifier)

[illegible]

SWITCH PC BOARD(NASW-2311A)

CIRCUIT NO.	PART NO.	DESCRIPTION
S352,S353	25035471	NPS-222-L433, Selector switch

VOLUME CONTROL PC BOARD(NAVR-2314)

CIRCUIT NO.	PART NO.	DESCRIPTION
R363,R463	5148101	N16RGM100KBTP30, Variable resistor

J2 25132316 NCPL-2316
J1 PL-901

EDGE LIGHT PC BOARD(NAPL-2316)

CIRCUIT NO.	PART NO.	DESCRIPTION
PL901	210064A	PL6.3V, 0.25A, Lamp

The diagram illustrates the audio section of a radio receiver, featuring the following components and connections:

- Input Section:**
 - TC-JC-3** (Transformer Coupled Jack) is connected to the **J301** jack.
 - J301** is connected to the **S301 TUNER** circuit.
 - J302** is connected to the **S302 PHONO** circuit.
 - J303** is connected to the **S303** circuit.
 - J304** is connected to the **S304 TAPE-2** circuit.
- Output Section:**
 - The **S301 TUNER** circuit is connected to the **J311** jack.
 - The **S302 PHONO** circuit is connected to the **J312** jack.
 - The **S303** circuit is connected to the **J313** jack.
 - The **S304 TAPE-2** circuit is connected to the **J314** jack.
- Other Components:**
 - REC R L** (Record Reel) is connected to the **J321** jack.
 - PLAY R L** (Play Reel) is connected to the **J322** jack.
 - REC R L** (Record Reel) is connected to the **J323** jack.
 - PLAY R L** (Play Reel) is connected to the **J324** jack.

The diagram also includes various electronic components such as resistors (R301, R302, R303, R304, R305, R306, R307, R308, R309, R310, R311, R312, R313, R314, R315, R316, R317, R318, R319, R320, R321, R322, R323, R324, R325, R326, R327, R328, R329, R330, R331, R332, R333, R334, R335, R336, R337, R338, R339, R340, R341, R342, R343, R344, R345, R346, R347, R348, R349, R350, R351, R352, R353, R354, R355, R356, R357, R358, R359, R360, R361, R362, R363, R364, R365, R366, R367, R368, R369, R370, R371, R372, R373, R374, R375, R376, R377, R378, R379, R380, R381, R382, R383, R384, R385, R386, R387, R388, R389, R390, R391, R392, R393, R394, R395, R396, R397, R398, R399, R400, R401, R402, R403, R404, R405, R406, R407, R408, R409, R410, R411, R412, R413, R414, R415, R416, R417, R418, R419, R420, R421, R422, R423, R424, R425, R426, R427, R428, R429, R430, R431, R432, R433, R434, R435, R436, R437, R438, R439, R440, R441, R442, R443, R444, R445, R446, R447, R448, R449, R450, R451, R452, R453, R454, R455, R456, R457, R458, R459, R460, R461, R462, R463, R464, R465, R466, R467, R468, R469, R470, R471, R472, R473, R474, R475, R476, R477, R478, R479, R480, R481, R482, R483, R484, R485, R486, R487, R488, R489, R490, R491, R492, R493, R494, R495, R496, R497, R498, R499, R500, R501, R502, R503, R504, R505, R506, R507, R508, R509, R510, R511, R512, R513, R514, R515, R516, R517, R518, R519, R520, R521, R522, R523, R524, R525, R526, R527, R528, R529, R530, R531, R532, R533, R534, R535, R536, R537, R538, R539, R540, R541, R542, R543, R544, R545, R546, R547, R548, R549, R550, R551, R552, R553, R554, R555, R556, R557, R558, R559, R560, R561, R562, R563, R564, R565, R566, R567, R568, R569, R570, R571, R572, R573, R574, R575, R576, R577, R578, R579, R580, R581, R582, R583, R584, R585, R586, R587, R588, R589, R590, R591, R592, R593, R594, R595, R596, R597, R598, R599, R600, R601, R602, R603, R604, R605, R606, R607, R608, R609, R610, R611, R612, R613, R614, R615, R616, R617, R618, R619, R620, R621, R622, R623, R624, R625, R626, R627, R628, R629, R630, R631, R632, R633, R634, R635, R636, R637, R638, R639, R640, R641, R642, R643, R644, R645, R646, R647, R648, R649, R650, R651, R652, R653, R654, R655, R656, R657, R658, R659, R660, R661, R662, R663, R664, R665, R666, R667, R668, R669, R670, R671, R672, R673, R674, R675, R676, R677, R678, R679, R680, R681, R682, R683, R684, R685, R686, R687, R688, R689, R690, R691, R692, R693, R694, R695, R696, R697, R698, R699, R700, R701, R702, R703, R704, R705, R706, R707, R708, R709, R710, R711, R712, R713, R714, R715, R716, R717, R718, R719, R720, R721, R722, R723, R724, R725, R726, R727, R728, R729, R730, R731, R732, R733, R734, R735, R736, R737, R738, R739, R740, R741, R742, R743, R744, R745, R746, R747, R748, R749, R750, R751, R752, R753, R754, R755, R756, R757, R758, R759, R760, R761, R762, R763, R764, R765, R766, R767, R768, R769, R770, R771, R772, R773, R774, R775, R776, R777, R778, R779, R780, R781, R782, R783, R784, R785, R786, R787, R788, R789, R790, R791, R792, R793, R794, R795, R796, R797, R798, R799, R800, R801, R802, R803, R804, R805, R806, R807, R808, R809, R810, R811, R812, R813, R814, R815, R816, R817, R818, R819, R820, R821, R822, R823, R824, R825, R826, R827, R828, R829, R830, R831, R832, R833, R834, R835, R836, R837, R838, R839, R840, R841, R842, R843, R844, R845, R846, R847, R848, R849, R850, R851, R852, R853, R854, R855, R856, R857, R858, R859, R860, R861, R862, R863, R864, R865, R866, R867, R868, R869, R870, R871, R872, R873, R874, R875, R876, R877, R878, R879, R880, R881, R882, R883, R884, R885, R886, R887, R888, R889, R890, R891, R892, R893, R894, R895, R896, R897, R898, R899, R900, R901, R902, R903, R904, R905, R906, R907, R908, R909, R910, R911, R912, R913, R914, R915, R916, R917, R918, R919, R920, R921, R922, R923, R924, R925, R926, R927, R928, R929, R930, R931, R932, R933, R934, R935, R936, R937, R938, R939, R940, R941, R942, R943, R944, R945, R946, R947, R948, R949, R950, R951, R952, R953, R954, R955, R956, R957, R958, R959, R960, R961, R962, R963, R964, R965, R966, R967, R968, R969, R970, R971, R972, R973, R974, R975, R976, R977, R978, R979, R980, R981, R982, R983, R984, R985, R986, R987, R988, R989, R990, R991, R992, R993, R994, R995, R996, R997, R998, R999, R1000, R1001, R1002, R1003, R1004, R1005, R1006, R1007, R1008,

SOURCE SELECTOR SWITCH PC BOARD(NASW-2308A)

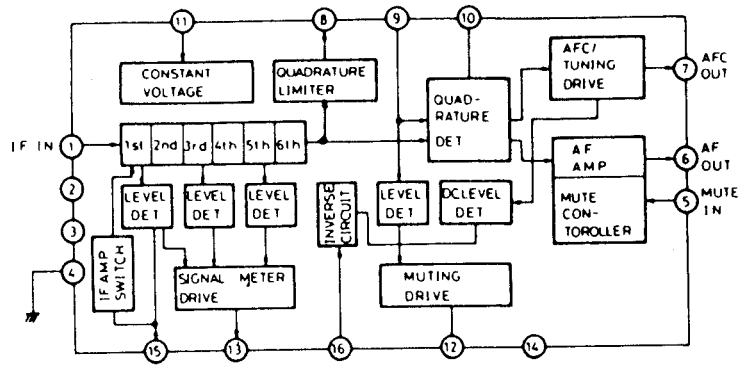
CIRCUIT NO.	PART NO.	DESCRIPTION
D301,D302	223124	1S2473,
	223145 or	1S2076TD or
	223150	US1040, Diode
S301-S305	25035468	NPS-542-L430, Push switch
P302,P303	25045142	NPJ-4PDBL55, Tape input/output
	25050143	NJPS-6P-S, Socket, jumper

TONE CONTROL CIRCUIT PC BOARD(NATC-2310)

CIRCUIT NO.	PART NO.	DESCRIPTION
R352,R452	5146049	N16RLC250KWT30, Balance control variable resistor
R353,R453	5148073	N16RQMC110K180K30, Bass control variable resistor
R361,R461	5148102	N16RGMC219K30, Treble control variable resistor

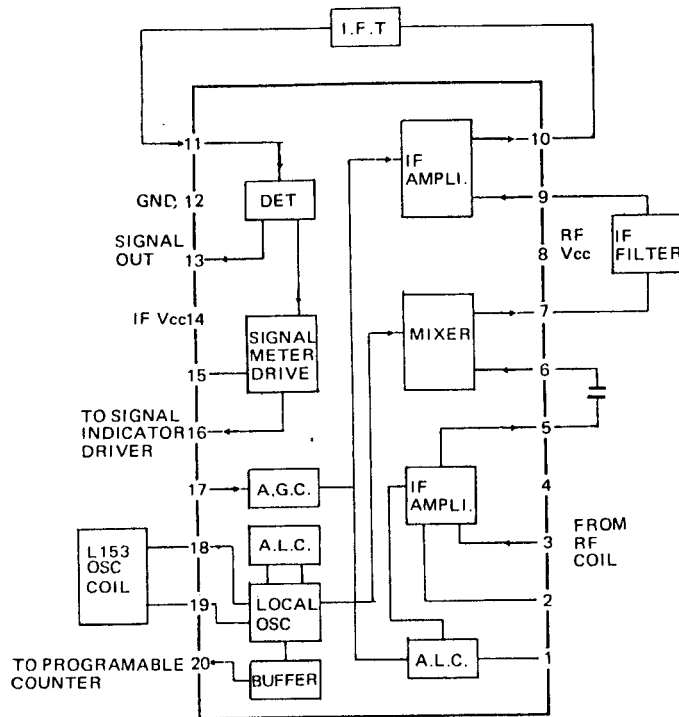
BLOCK DIAGRAM OF IC

HA-11225(FM IF system)

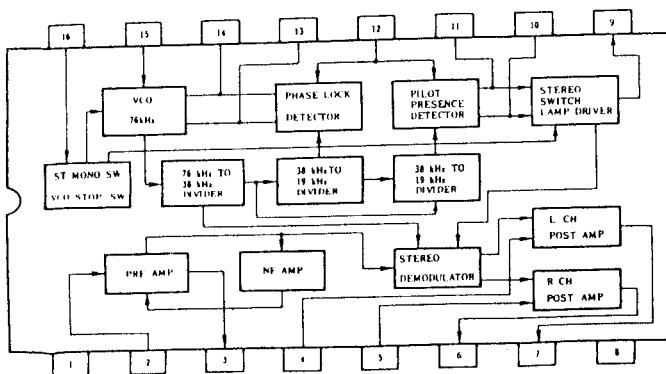


1. IF signal input
2. IF amplifier switch input
5. Muting switch input
6. Composite signal output
7. AFC output
8. IF amplifier output
9. 10.7MHz input
10. Reference voltage
11. Power supply
12. Muting output
13. Signal strength output
15. AGC output
16. Muting level

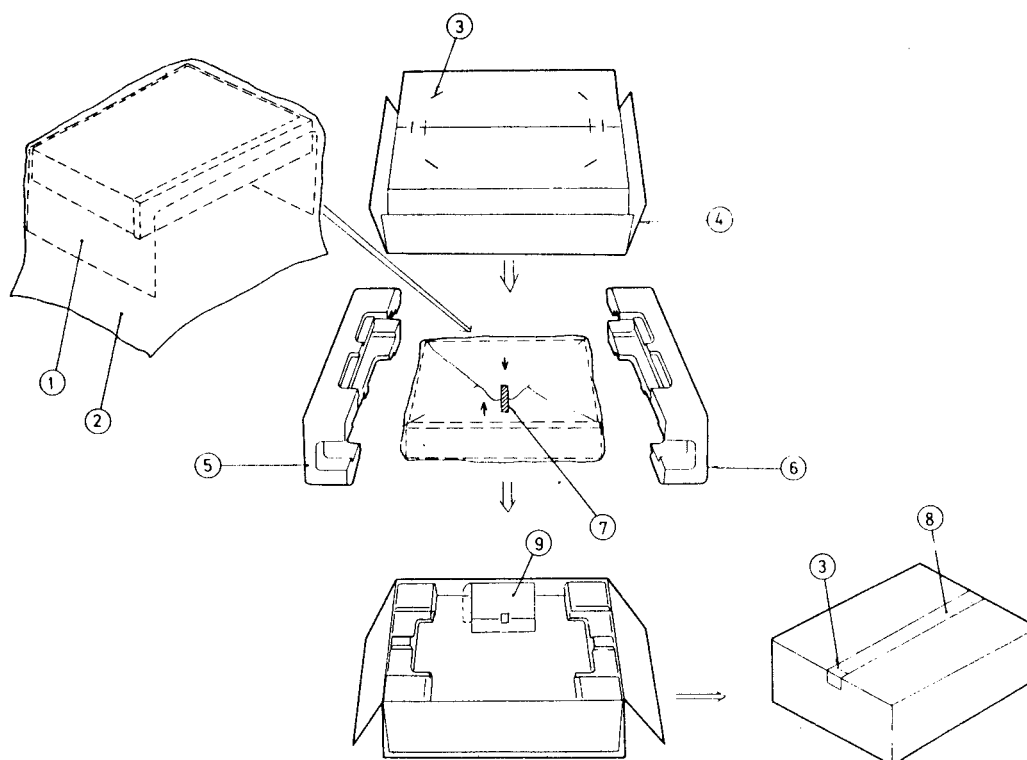
LA-1245(AM radio system)



μ PC1161C3(Stereo decoder)



PACKING VIEW



REF. NO.	PART NO.	DESCRIPTION
1	29095012-1	500×800mm, Protection sheet (B)
2	29100034	650×850mm, Poly-vinyl bag
3	282301	Sealing hook
4	29051094	Master carton box (S)
	29051095	Master carton box (B)
5	29090817A	Pad R
6	29090816B	Pad L
7	29110032	W=15mm, Adhesive tape
8	260012	50(W)×600mm, Damplon tape
9	Accessory bag complete	
	292092	FM antenna
	29100006	350×250mm, Poly-vinyl bag
	29340864	Instruction manual
	29365016	Warranty card

Note: (B): Only black model
(S): Only silver model